Physics Department Minor Incidents Log

Incident No.	2003-04	**Date:**	8/1/03
Reportable	No	**Date of Incident:**	4/9/03
Status	Final ES&H Committee Report		
Groups Involved:	Electron Spectroscopy		
Lead Investigator:	Peter Johnson		

Description:

On a Tier 1 inspection (January 8, 2003) the Group Leader who was a member of the inspection team halted operations in the Pulsed Laser Deposition (PLD) lab pending the completion of the exclusion zone for the beam between the laser and the sample chamber. The laser was originally positioned with the output of the laser directed toward the rear wall of the room but was changed at a later date to accommodate additional equipment which resulted in the beam being directed toward the front of the room with the beam not fully enclosed. The room is properly interlocked and the beam terminates in a target chamber. The only danger would be if someone put his hand or another object directly in the beam path between the laser and the target chamber – approximately 2 feet in length. The Tier I/ES&H Coordinator did not make this a corrective action since it was believed that the room was still being reorganized and the laser was not operating at that time and a new ESR would be written and reviewed before operations resumed. An inspection of the laser would be held in conjunction with the ESR review and any deficiencies would be taken care of at that time. The Group Leader reminded the researcher several times as did the ES&H Coordinator over the next few months that the beam had to be fully enclosed and a new ESR written before he could use the laser. The researcher agreed to this each time. A review of the Laser Lab logbook at the beginning of April indicated that samples were being made, despite the Group Leader's actions. On April 7, 2003 the Group Leader issued a Stop Work Order and subsequently initiated an investigation of the incident including a complete inspection of the lab area and procedures. The Group Leader notified the ES&H Coordinator who reported the incident to the Department Chair. It was determined that this incident needed to be investigated.

The Group Leader's investigation resulted in finding several Tier I type deficiencies in the room, lack of procedures and a schedule for checking laser interlocks, lack of a procedure and a schedule for calibrating the fluorine detector, use of the hood with chemicals that was not approved for use with chemicals, and changes that require an update or rewrite of the Experimental Safety Review (ESR) i.e. use of HF, reconfiguration of the position of the laser, optics, and the additional sample chamber. A review of the logbook revealed samples were made on 16 different dates between the January directive not to use the laser by the Group Leader and the official Stop Work Order given in April. Further examination revealed that the researcher had been using the laser prior to the January Tier I, which was not known by the Safety Organization.

Root Cause: **PERSONNEL ERROR – FAILURE TO FOLLOW ESTABLISHED PROCEDURES**

The researcher had been informed of the procedures by receiving the Department's training and was given directives by his supervisor and the ES&H Coordinator. In spite of this, he chose to use the equipment anyway.

Contributing Causes: None

Corrective Actions: Group

1. The Tier I type violations will be corrected – Completed at the time of this report.
2. The fluorine detector will be checked to see it is functioning properly and will be calibrated. A procedure for testing the fluorine detector needs to be developed and a logbook established for all tests.
3. The beam drift space between laser and sample chamber requires an exclusion zone in that area and will be enclosed.
4. A new ESR has to be submitted on the correct form to show new position of laser, additional sample chamber, any other new equipment, additional optics and reconfigured exclusion zone.
5. The use of hydrofluoric acid needs to be added to the ESR.
6. The PI must demonstrate that he knows how to use the HF kit that the Dept. required.
7. The hood in Laser Lab must be approved as a working hood, it is currently only to be used as an exhaust for the laser. Measurements will be made and if approved, space cleared for use in sample preparation.
8. Develop an interlock testing procedure approved by the Lab Laser Safety Officer and the ES&H Coordinator. A logbook needs to be established for this and tests scheduled according to BNL policy.

Since this was an Official Stop Work Order, Department Chair approval will be needed to resume work in the lab.

Corrective Actions: Department

1. Increase scrutiny of experiments that have conditions attached to their approvals to ensure completion of the requirements before experiments begin operations.
2. The Hazard Placard needs to be updated to show the presence of HF in the room when approved.
3. Group Safety Coordinators (GSC) will be informed and there will be discussion of this incident at the next GSC meeting, Group Leaders will be briefed, and the Department will be informed of the incident at the next Department Meeting.
4. The Department Management will ensure that the researcher understands the consequences of violating Department ES&H policies and operating outside the approved envelope of his Experimental Safety Review.

Lessons Learned:

The safety culture in the Department is not as ingrained as previously thought and varies from person to person. It is commendable that the Electron Spectroscopy Group on its own, with no outside intervention, recognized the unsafe condition, spoke to the researcher to correct the problem, and instituted an official stop work when it was clear he was continuing to operate without correcting the deficiencies. It is hard to understand why the researcher did not recognize the need to mitigate all safety hazards before working and why he chose to ignore the directives given by his supervisor to correct them. It is hard to understand why the BNL and Departmental ESR policies and procedures were not followed.

In addition, it is obvious that the deficiencies in the Laser Lab are easily remediated as most have already been corrected in a short period of time. The real problem is that they were allowed to exist and that operations continued as usual. Management must continue to stress that safety is an integral part of every experiment that cannot be ignored. Just as substrates are carefully prepared, parameters are set for the laser, optics focused, and vacuum level maintained in the sample chamber, so should safety be part of that formula.

The Department ESR Coordinator will have to have a greater role in the Tier I process. There must be more frequent inspections of experiments that have not fulfilled all their requirements to operate. In some cases the Safety Office will control the keys for operation, equipment may be locked out, or other means to insure unsafe conditions will be corrected before the experiment is allowed to operate. Discussion of whether or not this is necessary should be part of the regular ESR review process.

The above incident has been investigated and requires no further action.

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S. Aronson, Department Chair Date

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S. M. Shapiro, ES&H Committee Chair Date